The Pennsylvania State College
Correspondence Courses in Nature Study

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no. 6
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Insect Life

LESSON NO. 6

GREEN PLANT LICE

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WE may find green plant lice at any time of the year. Therefore, in taking up this subject, we should have by us some of these little insects. If it is during the winter months, we should look for them upon the house plants at our windows. Just here we will observe that they find some plants agreeable food and others not, for we never find plant lice upon the geranium or the india rubber plant; but, if the house plants have been neglected by the housekeeper, we are very likely to find them upon the rose geranium, heliotrope, callas and pelargoniums. They love the chrysanthemum, cinerarias and petunias. When you gather, observe that they are most abundant on the growing tips of the plants, indicating that they prefer the tender growth, just as we prefer our vegetables to be tender and crisp. Observe, also, if you have opportunity, that the plant lice on the various plants mentioned are in some slight characters different from each other, indicating that there are various species or kinds. We may as well state the fact here, also, that there are almost as many as the kinds of plants upon which they feed. To the casual observer, they differ usually only in color. Thus, we have the black plant lice on cherry trees, red plant lice on chrysanthemums, and green plant lice on roses. Then there are woolly plant lice, the individuals being covered with a white material of a woolly aspect, which is secreted from the body. But in this lesson, we will

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confine our thought almost exclusively to the most common form—the green plant louse, or aphis.

As you gather the insects, you will observe that they differ in size from a minute object scarcely visible to the naked eye to the size of a pin head, and you will assume at once that the small ones are the young and the large ones the old individuals (see Fig. 21). That is a correct assumption.

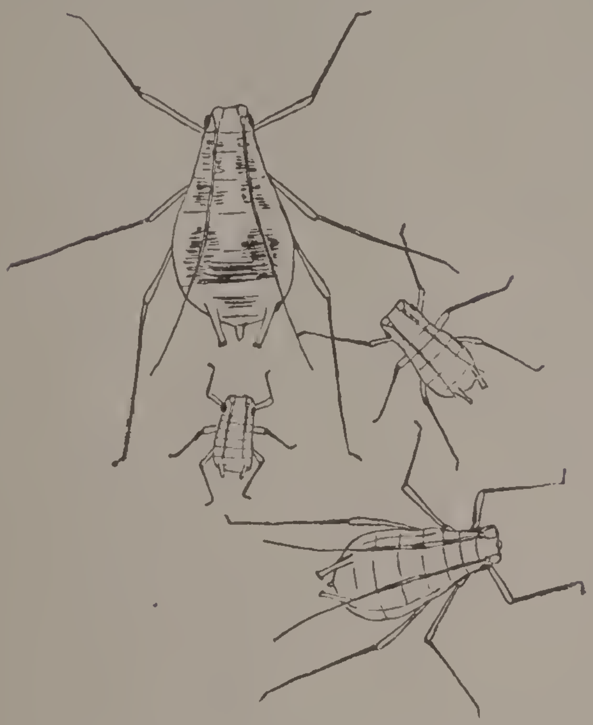

Fig. 21. Agamic female.
With young at birth and two successive moults. Magnified 15 times.
View from above.

Instead of taking the insects from the plants, take both for inspection, that the insects may be observed upon the branches where they occur. If you have a hand magnifying glass, observe next, by a side view, that the insects which are feeding have their mouths inserted into the tender stem of the plant, and remain at one spot as long as they are feeding. The mouth in this insect is a piercing proboscis. You will remember that in the house fly we observed a proboscis that took up food by lapping sweet liquids from the surface of objects. In the case of the green plant lice, the proboscis pierces the tissue of the plant, and draws the sap from the interior of the plant for its food.

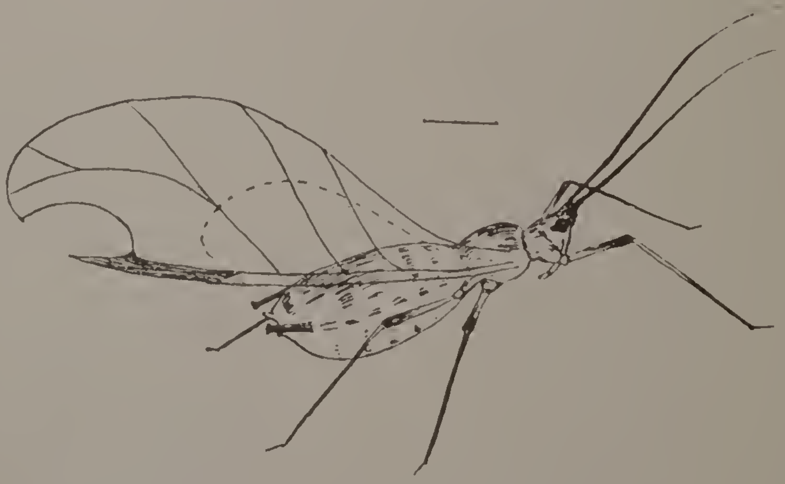

Fig. 22. Winged female. Magnified 7½ times.

Let us now observe the full-grown insect closely. First, as to color: the very young are almost white, as they increase in size become yellowish green, and, when full grown, black markings appear upon the body and at the joints of the appendages. There are a few individuals with wings. Look carefully, therefore, over all the material at hand, and see if you cannot find at least one or two with wings, for there are occasional individuals among plant lice that are winged. If you find them, you will notice that there are two pairs of wings held lightly over the body edgewise, one pair being much longer than the body, and all of them being delicate, transparent membrane (see Fig. 22). The body is more slender, and all the parts have more black coloring upon them than the wingless form. There is no other apparent difference between the winged and the wingless forms. The winged form is most likely to be a female. So are all the wingless ones. When walking, its antennæ are thrown forward instead of reposing back over the body, where the wings are proudly carried. This form, walking about, reminds one of a peacock strutting about with its gorgeous tail. If you will observe one awhile, you will see it stop in its march, raise its head into the air, its body perpendicular, spread the four wings broadly over the surface on which the insect is standing, and then gracefully readjust them to their usual position.

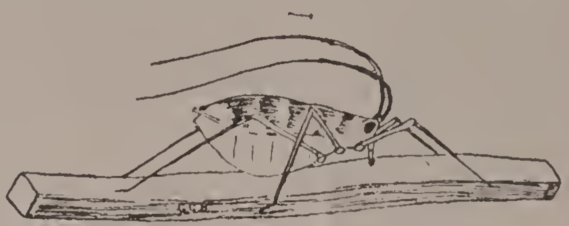

Fig. 23. Feeding.

These winged females are an essential factor in the propagation of the species, for when a plant becomes densely populated, the winged forms fly away to new plants and found new colonies.

But let us observe other facts about the insect. The eyes project boldly from the small head. They are black, and point in opposite directions. Remember the fact about the eyes of all insects, that they are compound, that is, many eyes in each of the two bundles; in this case, not so many by considerable as in the case of the house fly. The exact number is about one hundred in each bundle.

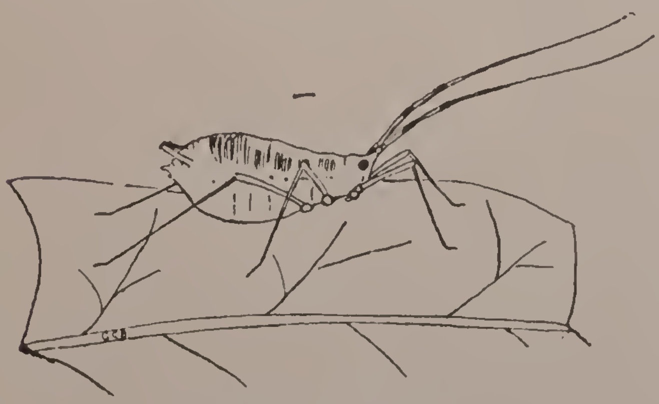

Fig. 24. Walking.

The antennæ are two long hairs proceeding from the head, thrown gracefully back over the body when the insect is not in motion (see Fig. 23). They are longer than the body, and jointed. A good glass will reveal about seven joints. When the insect is walking, these antennæ are thrown forward and are in constant motion, as if feeling for obstacles in the way (see Fig. 24).

Formerly you were told to observe that in insects the body is divided into three parts — head, thorax and abdomen — and it is to be regretted that so soon you find an exception, for the body of the plant louse is one solid piece, pear-shaped, with head at the narrow end. However, you will observe, as you continue to study this insect, that this is not the only exception which you will find in comparing it with a typical insect. You do find the six legs, which are very slender and comparatively long, each one terminated by a pair of minute hooks, which serve the insect to cling to plants.

Now let me call your attention to a most remarkable fact in the life history of this little animal, a fact which was not discovered by naturalists until the year 1743, when a close study of the plant louse was made by a Swiss — Charles Bonnet—and the report of his discoveries created great excitement in scientific circles. It was he who discovered the fact that the aphides, the name by which these plant lice are known to entomologists, give birth to young resembling their parents in the possession of legs, antennæ, eyes and proboscis. This, you see, is a remarkable exception to the rule in insect life, that the young are hatched from eggs, or that eggs are laid and the young hatched therefrom. So you must understand now that this insect does not pass through the four stages which we assigned to insect life—that is, the egg, the larva, the pupa and the imago. Bonnet made his discoveries by placing a single insect as soon as it was born upon a suitable plant, and so enclosed it that it could not escape and so that no other insects could enter. In eight days he found that the young plant louse was full grown and had given birth to a young insect. Others were born on successive days, until there was a family of ninety young of this one mother. He took from this cage one of the young as soon as it was born and isolated it, when, again, after eight days, the young began to be born. He continued this experiment through five generations, when, through some accident, he was forced to terminate this interesting work. He showed that each individual, under favorable circumstances, may become the mother of ninety children, and, by carrying the calculation of a possible progeny through several generations, he found that in the second generation the ninety children would produce 8,100 young; in the third generation there would be 729,000; in the fourth 65,610,000; and in the fifth generation there would be from the preceding 5,904,900,000, which would yield a progeny of 531,441,000,000. Now you can understand whence the millions of plant lice come, when, in early spring, you find the young growth of plants literally covered with these minute insects. You can understand, too, how plants must suffer when their vital fluids are being extracted by the thousands of these little insects.

This fact in the life history of animals is expressed by the word "viviparous", meaning bearing alive, as opposed to "oviparous", or the bearing of eggs. And these females are called agamic females, because the young are produced without the marriage of sexes.

This rapid multiplication of individuals is greatly operated against by diseases and enemies, and even by unfavorable weather. Therefore, we are not in danger of being driven from the face of the earth by increasing multitudes of these minute insects.

The insect enemies of plant lice are of two classes, those which eat the lice or suck their juices and those which lay their eggs within the bodies of the lice for the larvæ to develop there. The first class is termed *predaceous insects*, and familiar examples are the ladybird beetles, the little shining, hemispherical beetles, highly colored, red or yellow, with two or more black spots. The larvæ, as well as the beetles, devour the plant lice. The second class is termed *parasitic insects*, and the most common instance is that of a little ichneumon fly (Aphidius), not much larger than a full-grown aphis. It looks like a minute honey bee, and belongs to the same family. It pierces the aphis and inserts an egg. The larva from this egg lives in the body of the plant louse and causes it to swell and die. You may find clinging to plants the dead pearly bodies of such lice, with a circular piece of the back neatly cut out, hanging by a bit of the edge. From such a case the aphidius has escaped.

I have had five full-grown wingless females in captivity, and in two days they were attended by thirty-eight young ones, showing an average of four young per day to each insect. The life of an individual is eight days to maturity and about twenty-two days to its death, making from birth to death about one month.

Charles Bonnet further discovered the fact that the young in their growth moulted four times, and you may find on the plants among the insects many white skins clinging to the plants. In fact, you may find some clinging to the young insects which are in the act of moulting.

In the fall of the year another phase of the problem of reproduction appears, for, at this time of year, both sexes of the insect—both winged forms—are present and a limited number of eggs are laid, by means of which the species is carried through the winter out of doors. These eggs hatch into wingless females upon the approach of warm weather, and the viviparous reproduction begins again. The young hatched from the eggs are not in the larval form, but resemble the young of summer birth.

If an insect passes regularly through the various stages of insect life, it is said to have a complete metamorphosis, as in the case of the cabbage butterfly, but if one or more of the stages is wanting, as in our present subject, the metamorphosis is said to be incomplete.

There is another appendage to the body of which we have not yet spoken; that is, a pair of tubes projecting from the end of the abdomen, about one-thirty-second of an inch long, from which is secreted a sweet fluid. In some plant lice the secretion of this fluid is excessive, and is known as "honey dew." If it falls upon leaves, it makes their surface glossy, and pavements under trees attacked by many of these insects are made to look as if great drops of water had fallen from the trees.

Now we come to another very remarkable fact in the life history of our subject and its kind, for this "honey dew" is a food material very much enjoyed by certain ants, and many naturalists have observed that ants run up cherry trees and other plants because of the presence of the plant lice there; and when a small globule of the "honey dew" appears at the end of one of these tubes, the ant seizes it before it drops to the ground. It is said, also, that this wise little ant understands that by agitating the honey tube with its antennæ the secretion of the fluid is increased, and this phenomenon has been expressed by saying that the ant "milks" the plant louse, as man milks the cow.

This thought may be carried even further, for the ant is known to allure plant lice into its burrows in the ground and provide food in the burrow for the use of the plant lice, thus stabling and feeding, as it were, its herd of cows.

Many people think that the ants upon their plants are causing the latter to suffer, whereas, we know now, they are only an evidence of the presence of aphides, and a close inspection will reveal the true state of affairs.

SUGGESTIONS TO THE TEACHER

If you can find a plant with a goodly colony of plant lice upon it, you may find many interesting phenomena. There will be old and young, some feeding, some walking, some moulting, some giving birth to young, and some, perhaps, with wings. The moulted skins may be found about the plant, some clinging to the leaves where the insects are.

If you wish to observe the rapidity of reproduction, put a small quantity of water in a tumbler and place in it a leaf on which you have four or five mature lice ; cover over with a small pane of glass ; make a record, and observe the next day the increase, record results and repeat observation daily, until you have enough data to form definite conclusions. This experiment could be conducted in the schoolroom, where the pupils could also make observations.

In another tumbler put a definite number of young just born, to determine the number of moults and the time to maturity.

In another tumbler put ten mature aphides without any food material, and observe day by day if they give birth to young in the absence of proper food material.

Observe from these, also, whether there are any moultings after maturity of the insect.

You may observe occasionally a globule of "honey dew" appearing upon the tube when the insect stands upon its head, and, as if by a kick, the globule is thrown off. If a sheet of paper lies under an overhanging leaf under which are feeding many aphides, in a day or so you may see many glossy spots reflecting light from their surfaces. These spots are the "honey dew" drops.

TOPICS FOR WRITTEN ANSWERS

Teachers will discuss freely the following topics, not necessarily confining themselves to the lesson, but use information obtained from other sources. Write freely on the questions as topics for discussion rather than questions to be answered briefly.

Send answers to the Superintendent as soon as completed, and, if satisfactory, other lessons will be forwarded at once. In no case will a lesson be sent until the questions of a previous lesson are answered.

1. On what plants do you find green lice? (At the time of your study?)
2. Do these insects prefer the upper or lower side of leaves?
3. What is parthenogenesis? Does it apply to this subject? (Consult your dictionary.)
4. Why do ants run up cherry trees and other plants?
5. In what form do aphides pass the winter out of doors?

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